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PROPOSED RULE PR - Misc Notice
Reg. Guide

October 3, 1978

Subject: U.S. Nuclear Regulatory Commission
Regulatory Guide 1.120 (Rev. 1, Nov., 1977)
"Fire Protection Guidelines for Nuclear Power Plants"

Secretary of the Commission
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Docketing and Service Branch

Gentlemen:

The Nuclear Power Engineering Committee of the Power Engineering Society of the Institute of Electrical (IEEE) and Electronics Engineers, Inc. has been empowered to review and comment on the subject Regulatory Guide for IEEE.

An interim response to requests for comments on the Regulatory Guide was made in a letter dated February 9, 1973 from A. J. Simmons, Chairman of NPEC. This letter outlined serious concerns that IEEE had as to the progress of the Regulatory Guide within the NRC and the resolution of comments previously submitted by IEEE and others.

Attached are detailed comments on the Regulatory Guide which result from a careful review of the Regulatory Guide. These comments are submitted for your sericus consideration in modifying the requirements of the Regulatory Guide.

Yours very truly,

A. J. Simmons 10/17

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INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

POWER ENGINEERING SOCIETY

NUCLEAR POWER ENGINEERING COMMITTEE (IEEE/PES/NPEC)

COMMENTS ON

U.S. REGULATORY COMMISSION REGULATORY GUIDE 1.120,

"FIRE PROTECTION GUIDELINES FOR NUCLEAR POWER PLANTS"
Revision 1, November, 1977

Prepared by the IEEE Nuclear Power Engineering Committee,
Subcommittee 1, "General Plant Criteria"
September, 1978

PREFACE

The Institute of Electrical and Electronics Engineers - Nuclear Power Engineering Committee has reviewed Regulatory Guide 1.120 in detail and identified many areas of major concern. The requirements set forth in the Regulatory Guide clearly emphasize the protection of the physical plant and equipment against fire loss or damage without adequate regard to the adverse affects such protection may have upon the plant nuclear safety-related design features.

In general, the document still represents an acute overreaction to the Brown's Ferry Fire. If implemented in its present form, the design measures required could have the net effect of degrading overall plant nuclear safety in the pursuit of fire damage protection to the exclusion of other important plant design nuclear safety considerations.

The following are general and specific comments on the Regulatory Guide:

GENERAL CONCERNS

The "defense-in-depth" has been a useful and effective approach in designing safe nuclear power generating stations when applied to nuclear safety-related design features. In Regulatory Guide 1.120 this broad concept has been over applied to a single aspect of the plant design. This results in an unnecessary second-order "defense-in-depth" within an overall design "defense-in-depth."

The details of the fire protection "defense-in-depth" approach arbitrarily dismisses the effectiveness of the concepts of redundancy, separation and equipment qualification and overlays these concepts with an additional set of requirements. This results in a decrease in the level of nuclear safety, because of the complexity of interactions among the first order concepts and the new second-order requirements.

The objective of this new second-order "defense-in-depth" is evidently the reduction of risk to equipment and property from fire. The objective of the redundancy, separation and equipment qualification concepts is nuclear safety; i.e., the mitigation of release of radiation from the effects of design basis events, including fire. These two objectives, in many instances, are incompatible. In the past, the mitigation of release of radiation has always provided for sacrifice of equipment and property, where necessary, to protect the public.

Many of the provisions of the Regulatory Guide should be reconstructed to compliment and strengthen the first order nuclear safety-related "defense-in-depth" of redundancy, separation and equipment qualification rather than to compete with and dilute these concepts of primary concern.

The following general concerns are further expanded upon in the detail section.

It is unnecessary for the seal or closure in a fire barrier to have the same fire rating as the barrier. The rating of the barrier is usually a function of the limited availability of suitable structural design and materials rather than the existing degree of hazard.

The seal or closure may be chosen from a wide range of materials and, therefore, should only be of a fire resistance that is commensurate with the hazard to the plant design feature that penetrates the fire barrier.

It is not necessary for walls, floor and ceiling of rooms containing electric equipment to have three-hour fire ratings. The three-hour fire rating is related to withstanding a high temperature for three hours and retaining sufficient structural integrity not to be penetrated by a stream from a fire hose. The proposed requirement should allow a fire barrier rating that is consistent with the hazard. It is inconsistent and unreasonable to require the same rating for rooms containing switchgear, etc., as for rooms containing large quantities of stored diesel engine fuel oil.

Extensive use of sprinkler systems over raceways, switchgear and control panels is not necessary.

It is improbable that the "32 fires in operating U.S. nuclear plants through December 1975" referenced in the Regulatory Guide, started from a faulted cable in a cable tray. Typically, as in the case of the "Brown's Ferry Fire", external agencies (workmen) started the fire during construction, repair or maintenance activities. An automatic sprinkler system in such a case provides little advantage over the usual fire extinguishers and hose stations coupled with a trained "fire watch". In fact, the complexity of a sprinkler system that could be effective for banked cable trays would create a less reliable alternative. The lower reliability would result from complexity of configuration and automatic control features and from the possibility of spray simultaneously damaging redundant safety components in an unanticipated manner.

Sprinkler systems in control rooms, switchgear rooms and other equipment areas are unnecessary if proper separation is provided. A sprinkler system triggered spuriously or by a localized equipment fire could cause catastrophic common mode failure of the entire equipment configuration.

A well-engineered fire protection system is a custom design based on the hazard, the degree of risk, the type of equipment involved, the type of fire protection system available and the overall hazard protection objectives. It should not be a "cookbook" approach that allows no alternatives or valid deviations.

DETAIL CONCERNS

The following detailed concerns are referenced to the applicable page and section of Regulatory Guide 1.120 (November 1977):

Section A - Introduction

Comment 1 (Page 1, First Paragraph)

The key phrase in General Design Criterion 3 is "consistent with other safety requirements" which is interpretable to mean the following:

(1) The methods of postulating fire events, their effects on safety-related components, and design measures to minimize these effects should be no more or no less strenuous than those applied to other events beside fire.

(2) The fire protection design measures should not be pursued to the disadvantage of other safety related design goals.

Neither of the above valid objectives has been fulfilled in the detailed portions of the Regulatory Guide.

The last sentence of the first paragraph states "that fire-fighting systems shall be designed to ensure that their failure, rupture or an inadvertent operation does not significantly impair the safety capability of these structures, systems and components" is a very important statement. The discussion and regulatory positions that follow do not recognize this statement when positions are taken that water must be used in nuclear power plants to fight fires.

Comment 2 (Page 1, Third Paragraph)

The third sentence is incorrect. Regulatory Guide 1.75 gives requirements for distance and/or barriers; the Regulatory Guide invalidates those requirements by requiring fire walls between redundant components, etc.

Section B - Discussion

Comment 3 (Page 1, First Paragraph)

The third sentence infers that the frequency of fires at nuclear plants is in the order of one per ten reactor years. It would be of more benefit to provide a better statistic on potential severity of fires so that the Browns Ferry Fire and trash can fires are not lumped into one category, with both having the same effect upon the need for improving fire protection in nuclear plants.

The fifth sentence is in contradiction with the rest of the document. The "defense-in-depth" concept as implemented in this document is obviously not "cost effective" since it calls for fire protection features regardless of whether physical arrangement of safety-related equipment and barriers are sufficient to prevent their failure due to a credible fire.

Comment 4 (Page 1, Second Paragraph)

This paragraph references "International Guidelines." This reference should be analyzed carefully because it speaks only of fire protection and does not concern itself with protecting safety-related systems. As such, it is con-concerned primarily with loss prevention and, therefore, is inappropriate as a reference for a Regulatory Guide whose chief concern should be nuclear safety. Also, The International Guidelines referenced describe a fire stop which may be unacceptable because it is as thick as the concrete wall it penetrates. Concrete walls in power plants are on the order of two to four feet thick and such a thickness for a fire stop may cause overheating of power cables and, in fact, could actually contribute to the starting of a fire.

Section B.1. - Defense-In-Depth

Comment 5 (Page 2 - In General)

Defense-in-depth is certainly a recognized principle. However, the statements outlining defense-in-depth neglect two important items that should be added. One item involves the application of administrative and security measures to prevent access to areas by unauthorized personnel. The second item should address designing plant safety systems so that operation of fire protection features does not cause failures or render inoperative nuclear safety features. Again, this last statement is important because experience has demonstrated that operation of sprinkler and water hoses will introduce water into areas of the plant that find its way into essential electric equipment.

Comment 6 (Page 2, Section B.1.c)

Exactly what is required should be clarified. Is the fire protection system to be categorized as Nuclear Safety-Related, or not? The document must be clear on this. Certainly the fire protection sprinkler piping in areas housing nuclear safety related electrical equipment will need to be Seismic Category I to minimize (but not necessarily eliminate) the flooding hazards brought about by the introduction of such a system. The discussion about a Seismic Category I water system source and the statements of other require-ments that follow seem to imply that the fire protection system is intended to be classified as Nuclear Safety-Related.

The degree to which (QA) programs, as stated in the fourth paragraph, are to be applied to fire protection system design, construction and operation should be outlined in detail.

Comment 7 Section B1 (Page 2, third Paragraph)

The 5th sentence in the 3rd paragraph states "Generally, in plant areas where the potential fire damage may jeopardize safe plant shutdown, the primary means of fire protection should consist of fire barriers and fixed automatic fire detection and suppression systems." This statement over-emphasizes the need for fixed automatic fire suppression systems; whereas, in most areas, fire suppression using manual fire fighting capabilities is entirely adequate. In general, fixed fire suppression systems are needed only where adequate fire suppression cannot be provided by manual fire fighting. This is not an arbitrary position but is simply sound engineering judgment

in that unnecessary systems can complicate the operation and maintenance of the plant and can reduce the overall reliability and may even reduce safety.

Emphasis should be reoriented such that in areas where fire may jeopardize safe plant shutdown, fire protection should consist of fire barriers and/or adequate physical separation in addition to methods of fire detection and suppression. Fixed fire suppression systems should be used in areas where adequate fire suppression can not be provided by manual fire fighting.

Section B.2. - Use of Water on Electric Fires

Comment 8 (Page 2 - General)

In the first paragraph, the first sentence states "experience...show water should be used." Actually, the water could be a larger hazard to plant safety than the fire itself. Experience at major utilities indicates that water in a power plant can flow where it is not expected to go and, in so doing, finds its way into electrical equipment causing electrical faults and electrical outages. It must be recognized that water sprinklers and hoses are a major hazard in nuclear plants since such water cannot be controlled. Water then becomes a potential common mode for failure mechanism for redundant Class 1E electric systems and reactor protection systems. This, of course, violates the "Defense-in-Depth" that has been stressed. Experience reports listing cases of water damaging electric equipment have been reported for utility power plants. NRC has some of these reports. NRC also has reports from Atomic Energy Clearing House where water damaged electric equipment. Large-scale application of water from fire hoses and sprinkler systems will escalate damages indicated by such reports. The result in a nuclear plant would be an extensive loss of Class 1E electric equipment and safety systems.

The second sentence in the first paragraph states that "...prompt extinguishing of the fire is vital to reactor safety", and that "...fire and water damage...is reduced by the more efficient application of water from fixed systems spraying water directly on the fire rather than by manual application with fire hoses." Prompt extinguishing of any fire is, of course, desirable but not necessarily vital. In the majority of cases, such as in isolated redundant safety-related pump rooms, a fire could be allowed to persist without jeopardizing safe shutdown because of limited amounts of combustibles and complete isolation by fire barriers. In other cases, credible fires can be adequately controlled and suppressed by manual fire fighting.

Also, we cannot agree with the unqualified statement that fire and water damage to safety systems is reduced by the more efficient application of water from fixed spray systems. For example, a faulted electrical cable in a cable tray producing localized smoldering in the region of the fault could be extinguished by manual suppression without subjecting the entire room to water damage from the spray system. The merits of fixed water spray systems versus manual fire fighting depend on the nature of the fire hazard, the consequences of the fire and the consequences of the method of fire suppression.

In view of the above, the second sentence is not valid and should be deleted in its entirety from the Section.

The second paragraph states that equipment that may be damaged by water should be shielded or relocated away from the fire hazard. This is true, but the statement should be much stronger. It should include requirements for protection from running water. This could be a sound concept if this protection for the falling and running water was also addressed. Other parts of the Regulatory Guide violate this statement directly where guidelines call for hose stations, plant computer room (Page 19), switchgear rooms, (Page 20) and remote safety related panels (Page 20). It must be recognized that the electrical equipment in a nuclear power plant can easily be damaged by water, unless special protective measures are taken for the equipment itself. The statement at the end of the second paragraph discusses drains but in no way does it provide protection that is essential for electric equipment.

Section B.3. - Establishment and Use of Fire Areas

Comment 9 (Page 3, Second Paragraph)

The first sentence of the second paragraph directs the reader's attention to fire areas containing safety-related systems. In some cases, the adjacent areas contain major fire hazards which should also be given special attention. Perhaps the sentence could be expanded to include the above concern as follows:

"Special attention should be given to the detection and suppression of fires in areas containing safety-related systems and in adjacent areas containing fire hazards that may adversely affect the system."

Comment 10 (Page 3, Third Paragraph)

Which of the indicated methods of limiting the consequences of a fire should be used -- ventilate, exhaust, or isolate? If the Regulatory Guide is to give the specific guidance promised, the topic of venting versus sealing the fire must be addressed in detail.

The requirements for power and controls for the ventilation equipment to be separated from the area in some cases may be impossible. The Standby Diesel-Generator Area or Building ventilation system power and control cables are a good example. Providing power and controls from outside would add considerable complexity to the design without providing any additional safety.

Section 4.0 Definitions

Comment 11 (Pages 3 and 4)

Approved

The requirement to use a nationally recognized testing laboratory or an approved laboratory is not justified. Any laboratory qualified to conduct the test should be permitted, provided the tests are witnessed and certified by cognizant individuals. This is consistent with the qualification of safety-related equipment.

The definition should be expanded to allow the use of construction labels such as UL or FM but whose configuration has not been tested. The definition should also not exclude devices, components, and/or assemblies which have been tested and approved in accordance with the ANSI, IEEE, ASME or other nationally recognized Standards writing boards.

Fire Barrier

"...by approving laboratories" should be deleted. (See comment on definition for "Approved.") The ratings could be established by prototype testing from laboratories other than UL and Factory Mutual (ie: an industry fire test facility such as Portland Cement Association, Wyle Laboratories, etc.)

Safety Related Systems and Components

Add the words "under design bases event conditions" between the words "shut down" and "the reactor." These systems and components are not required for normal reactor shutdown or for emergency shutdown that is not a "design basis event."

Section C. - Regulatory Position

Section C.1. - Overall Requirements of the Fire Protection Program

Comment 12 (Page 5, Section C.1.a. - Personnel)

Fire protection staff personnel qualification in the field of fire protection and nuclear plant safety should be by adequate training or experience or a combination of both.

The "note" reference to NFPA 6 on Fire Loss Prevention is inappropriate to a document whose primary concern should be nuclear safety and not loss prevention.

Comment 13 (Page-6, Section C1-d(1)

The statement that fires need not be postulated to be concurrent with the most severe natural phenomena implies that fires might be considered concurrent with less severe natural phenomena such as operating basis earthquakes (OBE). In our judgment, fires need not be postulated to be concurrent with any natural phenomena.

Also, it should be stated in this section that fires occurring simultaneously in more than one area need not be considered.

Comment 14 (page 7, Section C2-c(3)

The requirement that wood (scaffolding, laydown blocks, etc.) be allowed in safety-related areas only when they are to be used immediately is unrealistic. It would not be practical to attempt, for example, to erect and tear down scaffolding on a daily basis to meet this requirement. Moreover, this type of activity can be more hazardous to safety-related equipment in the area than the potential fire hazard of the material (which is extremely low due to the requirement that the wood be flame-retardant).

Comment 15 (page 8, Section C2-c(4)

The term "permit system" for controlling the disarming of fire detection and suppression systems is indefinite. We believe it is adequate to state that such disarming be under administrative control. Also, it would be appropriate to include disarming of fire door and damper operators.

Revise first sentence of paragraph C2-c (4) to: "Disarming of fire protection systems and components such as detectors, suppression systems, fire door and fire damper operators, should be under administrative control."

Comment 16 (Page 8 Section C.3 General Comment)

The QA Program described here is similar to that imposed on safety-related systems. It should be stated that such a program is only applicable to those portions of the fire detection and suppression system whose failure or inadvertent operation could degrade safety related components. In effect, this should be interpreted to limit the QA to those portions of the fire suppression system required to operate during a low order probability design basis event, such as a SSE.

Section C.4. - General Plant Guidelines

Section C.4.a. - Building Design

Comment 17 Page 9 Section C4-a(1)

The requirement that fire barriers have a three hour rating is arbitrary and cannot be justified for areas with relatively low fire loading. The requirements for fire resistance ratings of barriers should be based on the fire loadings in the fire hazard analysis. There is considerable conservatism in the fire loadings and in the fire resistance ratings relative to the ability of fire barriers to prevent the propagation of fire through the barrier. In view of this conservatism, it should be adequate to establish fire barrier requirements from the fire hazard analysis rather than the arbitrary three hour rating for all barriers.

Paragraph C4-a(1) should be revised to read: "Fire barriers with a minimum fire resistance rating of three hours should be used, except where lesser ratings can be justified by the fire hazard analysis or as noted in other paragraphs, to:"

Comment 18 (Page 10, Section C.4.a.(1)(b)

The guide states that "plant layouts should be arranged to separate redundant safety-related systems from each other so that both are not subject to damage from a single fire hazard." It should be made clear that physical separation, rather than barriers is acceptable in meeting this criteria.

Comment 19 (Section C.4.a.(2)

It appears totally unjustified to require fire barriers "...within a single safety division to separate components that present a fire hazard to other safety-related components or high concentrations of safety related cables within that division." This requirement represents on overkill with respect to Criterion 3 of 10CFR Part 50 which "...requires that fire detection and suppression systems of appropriate capacity and capability be provided and designed to minimize the adverse effect of fires on structures, systems,

and components important to safety..." It should recognized that the fire must involve the redundant divisions in order to have any adverse effect on safety-related systems. It appears the requirement in this paragraph addresses only the property protection in the plant and should be deleted from the regulatory guide.

Comment 20 (page 10, Section C4-a(3)

The requirements for cable spreading rooms are treated in Section 6-c "Guidelines for Specific Plant Areas;" and since they are more appropriate in Section 6, they should not be duplicated here.

Comment 21 (Page 10, Section C.4.a.(7)

The statement requiring insulation and cooling with noncombustible liquid is too stringent according to the definition for noncombustibles. Noncombustibles should be changed to flame retardant.

Comment 22 (Page 10, Section C.4.a.(8)

This section requires a three hour fire wall where NELPIA requires two hour rated walls. The rationale for this increase in rating would be helpful in assessing the alternatives of a balanced fire protection system. When a water spray system for transformers is provided, to reduce the fire hazard, the necessity for a three hour fire wall should be relaxed.

Comment 23 (Page 11, Section C.4.a.(10)

Ratings of fire barriers should be related to the hazard contained and not the inherent capability of available structural materials. Seals and closures for electric cables and raceways should be rated for the hazard and not for the barrier rating.

Locking of doors should only be necessary for security purposes. Automatic closure of fire doors and a periodic check of the "closed" condition should be sufficient. Locking of these doors could prevent access to vital areas when access is necessary.

Section C.4.b.- Control of Combustibles

Comment 24 (Page 11, Section C4-b(1)

The stated requirements are not germane to the subject heading "Control of Combustibles," and are adequately and more appropriately addressed in other parts of the Guide. It would be more appropriate to provide guidance for control of combustibles as follows:

Replace paragraph C4-b(1) with "The use of combustible materials in permanent equipment and structures should be limited as much as practical without compromising the performance of equipment or the integrity of structures. The control of combustibles during operation and maintenance should be under administrative controls as outlined in Section 2."

Comment 25 (Page 11, Section C.4.b.(4)

The reference to NFPA 30 is inappropriate. NFPA 30 was not written with nuclear safety in mind.

Section C.4.c. - Electrical Cable Construction, Cable Trays and Cable Penetrations

Comment 26 (Page 11, Section C4-c (1)

The requirements for using only metallic conduits and for not permitting the use of thin-wall metallic conduit are unnecessarily restrictive. Non-metallic conduit should be permitted where buried or encased in concrete, and thin-wall conduit should be permitted where buried or encased in concrete or where exposed when used for low power circuits such as for lighting and communications.

Paragraph C4-c(1) should be revised to permit the use of non-metallic conduit and thin-wall metallic conduit as indicated above.

Comment 27 (Page 11 and 12, Section C4-c(2)

Because this section of the reg. guide is long and complex, the following comments are submitted by general topic headings.

a. Fire Barriers: The requirement for three hour fire barriers is entirely arbitrary and unjustified. See our comments No. 17, 18 and 19.

b. Continuous Line-type Heat Detectors: The unconditional use of these detectors in all redundant safety-related cable trays throughout the plant is very arbitrary and unjustified. We strongly object to this requirement for the following reasons:

1. Properly designed cable tray systems with proper overload protection should not produce hot spots.

2. Cable faults with modern flame-retardant cables and with proper overload protection are not likely to cause cable fires.

3. In the unlikely event that a cable tray fire is initiated, they are relatively slow propagating, for which area fire detection is adequate and is required anyway.

4. Cable conductor temperatures as high as 250°C are possible under through short circuit conditions which could cause unnecessary false alarms and undesirable operation of fire suppression systems.

5. If the line-type heat detectors are installed along the axis of the trays, they would not be effective in detecting burning cables at all locations in the tray. If they are installed in a zig-zag pattern on the top of the cables, it will make the addition of cables at a later date very difficult.

6. Functional testing of a large number of this type of detector would be very difficult and expensive and could jeopardize the safety-related cables.

7. It is a very costly installation.

c. Automatic Water Extinguishing Systems for Exposure Fires: The requirements in the second paragraph, if strictly implemented, would result in automatic water extinguishing systems in many areas regardless of the actual need for such systems. This requirement should be justified and at least some practical limitations established. The amount of cable, the type of cable (power, control or instrumentation), the location of trays related to areas where outside combustibles are apt to be found, and whether or not only one safety division or one or more safety systems within a division have cables in a tray system should be considered before the requirement for a fire protection system sprinkler system is made a blanket requirement.

For example, one method of not defeating a safety system function is by only allowing one division of a redundant safety system function to be exposed to a particular fire hazard. The single failure criteria is met for the safety function and present day standards for separation would also be complied with. It would seem that this should also be an acceptable method of insuring nuclear safety.

Another example where the need of an automatic water extinguishing system is questionable is a redundant safety-related pump room containing a cable tray associated with the equipment in the room and in which the pump contains a couple of gallons of lube oil. The amount of lube oil and/or its physical separation from the cable tray is often such that no automatic water extinguishing system is needed. Moreover, the loss of the redundant safety division and safe shutdown due to a lube oil fire would be independent of possible damage to the cables.

In addition, we would consider the possibility of inadvertent operation of one of the large number of automatic extinguishing systems high. The inadvertent operation of an automatic extinguishing system could well result in a safety hazard of much greater significance than the fire hazard being protected against.

All trays ultimately lead to electrical equipment. The trays and the cable in the trays are not generally adversely affected by water but the electrical equipment that is in the vicinity of the trays and that which the trays lead to is subject to moisture or water damage. The trays, particularly solid bottom trays are good paths directing the water to the electrical equipment. Even though protective measures are taken it is very likely that some moisture would reach the electrical equipment and cause damage.

This section, in requiring that safety-related equipment in the vicinity of cable trays be protected from sprinkler system operation or malfunction, is one of the few sections in the entire document that describe protective features for safety-related equipment. The requirement is buried in this section on electrical cable construction and should be greatly expanded. Most safety-related equipment in the plant is subject to damage by water from sprinkler systems. This means that all safety-related equipment has to be protected from both direct application of water and from possibilities of water running down and into equipment from remote locations.

Requiring that all safety-related equipment be capable of withstanding the affects of sprinkler system operation would increase the current "environmental qualification" requirements and would require a redesign and requalification of most of the currently qualified Class 1E (electric) equipment.

This section should be made clear regarding the necessity of considering protection of equipment against malfunction of or maloperation of hand held hoses.

In any event, restricted use of only automatic water sprinkler systems is unnecessary for cable trays. Other methods of fire suppression, such as CO_2 systems and application of ablative materials to cables in trays, should be recognized as being acceptable.

Automatic fire extinguishing systems should only be used where the fire hazard and safety analysis shows that manual fire fighting would be inadequate.

We believe the above underlined statement is the fundamental criteria for the application of automatic fire extinguishing systems and should be used in lieu of the very arbitrary and unjustified requirements in the Reg. Guide, which seem to completely ignore a balanced engineering approach to fire protection based on a fire hazard and safety analysis.

d. Fire Hazards of Electrical Cable Systems: There appears to be an inordinate concern directed toward the fire protection of electrical cables. The main question appears to be: "What is considered adequate protection for cable systems?" In order to answer this question, outlined below is what industry is doing and what it considers adequate fire protection.

Modern cable systems are designed for fire prevention and protection using the following techniques:

1. Thermal loading is analyzed and limited to values well within the cable thermal capacities to prevent hot spots and insulation degradation.

2. Overcurrent protection devices are employed in high energy circuits to disconnect circuits in the event of high overloads and short circuits.

3. Cable systems are protected from external fire hazards by physical separation and/or barriers.

4. Electrical cables are constructed to have flame retardant properties such that they are self-extinguishing.

5. Redundant safety system cable trays are installed with physical separation and/or barriers in accordance with IEEE 384 criteria.

6. Fire detection (smoke detectors) is provided in areas containing a significant amount of cable for early warning of fire.

7. Manual fire fighting using portable extinguishers and water hoses is provided for all areas.

8. Administrative controls and surveillance are used to protect the system from operations and transient combustibles that could become fire hazards.

With the implementation of all of the above measures for the fire prevention and protection of cable systems, it is difficult to understand and justify the need for additional protection such as fixed fire extinguishing systems where the only potential fire hazard is the cable system itself.

The cable tray fires that have been experienced including the Brown's Ferry fire clearly indicate that:

1. Cable tray fires are relatively slow to propagate and have a relatively low rate of heat release.

2. Manual fire fighting using water hoses is adequate for extinguishing such fires, even when they have been allowed to burn for a considerable time.

Moreover, the recent Sandia cable tray fire tests in addition to supporting the above statements, also indicated that:

1. Overheated cables give off smoke for a significant time before ignition so that early warning from smoke detectors can be expected.

2. The sphere of influence of the fire is limited so that the independence criteria in IEEE 384 appear adequate.

3. Flame retardant cables (per IEEE 383) are extremely difficult to ignite (by themselves) and are self-extinguishing.

In view of the above, it is suggested that a reevaluation of the potential fire hazards associated with cable systems be made with the goal of eliminating the need for fixed automatic fire extinguishing systems particularly where only one safety division is affected and/or where the only potential fire hazard is the cable system itself.

Comment 28 (Page 12, Section C.4.c.(3)

Seals for cable and cable tray penetrations of fire barriers should have a fire rating relating to the hazard; not to the inherent fire rating of the fire barrier which it penetrates. The inherent fire rating of the barrier may have been dictated by other design features such as structural strength. Cable penetrations that are arbitrarily required to be as thick as the fire barrier could result in high operating temperatures for power cables, within the penetration seal and increase the possibilities of a fire.

It is questionable whether the ASTM E-119 hose stream test for building walls (without penetrations) is applicable to a cable penetration fire stop. A modified test more applicable to a penetration fire stop should be st ted or referenced.

Comment 29 (Page 12, Section C4-c(4)

Fire stops are not needed in cable trays under any conditions due to the low rate of heat release, slow fire propagation, and self-extinguishing properties of modern flame-retardant cables. The fire tests performed by Sandia Laboratories indicate that propagation of cable fires in horizontal configurations do not warrant fire stops in horizontal trays.

There is no justification for the requirement of intermediate fire stops within a fire cell. Other parts of the guide establish the boundaries and protection requirements within the boundaries. Conceptually, the entire fire cell could be burned out without sacrificing plant safety. This is another example of over-reaction to electrical cable fires and should be deleted.

Comment 30 (Page 13, Section C.4.c(5)

The sentence in parentheses should be clarified or dropped.

Comment 31 (Page 13, Section C.4.d.(2)

This section requires that a "single failure criterion" be applied to the vent system which exhausts smoke or corrosive gases during a fire. Since such a system is not nuclear safety grade, the basis for performing a single failure analysis on such a system should be outlined in detail in the Regulatory Guide.

Comment 32 (Page 13, Section C.4.d.(6)

The requirement that stairwell ventilation be designed to minimize smoke infiltration could be interpreted to mean fan or natural circulation ventilation systems. Clarification of the intent is required and whether positive pressurization is required or not. Also, whether all stairwells should be enclosed, or only those required for fire exit and access.

Section C.4.e. - Lighting and Communication

Comment 33 (page 13, Section C.4.e.(1)

This section requires that fixed emergency lighting system should consist of sealed beam units with individual 8-hour minimum battery power supplies be provided. Instead of limiting emergency lighting systems to individual battery operated units, an alternative acceptable method should be to provide a prime mover operated electric generator to supply emergency lighting power.

Comment 34 (Page 14, Section C4-e(3)

The normal in-plant communications system, supplemented by the portable radios required by paragraph (4), provides adequate communciations without a separate fixed communications system.

Section C.5 - Fire Detection and Suppression

Comment 35 (Page 14, Section C.5.a.(4)

Use of local audible alarms is questionable because of limited access to most areas. Alarms should be provided in attended areas, such as control room and/or guardhouse. A general building alarm or use of communication system should be provided for alerting personnel.

Comment 36 (Page 15, Section C5-b (3b)

The electric motor driven fire pumps need not be Class 1E.

Comment 37 (Page 16, Section C.5.c(1)

The last sentence makes minor reference to protecting safety-related equipment from water hazards "if wet by sprinkler water discharge" and requires such equipment be protected by water shields or baffles. This statement needs to be greatly expanded along with the other minor statements in the Guide that address protecting equipment from hazards of water. Shields and baffles are inadequate. Experience with running water in plants indicates that water will find its way into all types of electrical equipment. The only way to protect electric equipment is require watertight enclosures. This can be done by requiring NEMA 4 construction for small equipment and completely waterproof enclosures for larger equipment. All cables that enter equipment have to be completely sealed and this is practically impossible to do for 40 year life of power plants. Keeping water away from all electric equipment or designing watertight enclosures are the only means of protecting electric equipment from water.

This requirement, if implemented using waterproof enclosures, would result in the redesign and requalification, to IEEE 323, of most of the Class 1E equipment in current use. The resulting "new" equipment design, since it would have no operating history, could result in a decrease in the overall reliability of safety related systems.

Comment 38 (page 16, Section C.5.c.(4)

The requirement for manual hose stations at all locations in the plant is too extensive. The location of standpipes and hose connections should be based on potential for combustion. In many cases, portable extinguishers should suffice.

Comment 39 (Page 17, Sections C.5.d. and C.5.e.)

The role of these paragraphs in the Regulatory Guide should be clarified since Halon and Carbon Dioxide suppression systems are not called for elsewhere. These two system types are acceptable for electrical equipment because they do not cause equipment failures. This section should be expanded with reasons and areas of possible application.

Section C.6 - Guidelines for Specific Plant Areas

Section C.6.a. - Primary and Secondary Containment

Comment 40 (Page 18, Section C.6.a.(1) - Normal Operation)

The need for fixed fire suppression for cable trays and penetrations should be based upon the separation of trains and density of trays, not merely the fact that they are there.

The second paragraph states "operation of fire protection systems should not compromise the integrity of containment or other safety-related systems." This is another example where safety-related system protection is mentioned in the Regulatory Guide. This should be greatly expanded because water from fire protection systems will invariably damage safety-related electrical systems.

Automatic fixed sprinklers within the containment introduce the consideration of whether a malfunction of the system could result in damage or malfunctioning of safety-related systems. Manual operation could preclude this type of damage and appears to be a preferable mode of actuation.

The backup fire detection requirement, stated in the fourth paragraph, for the containment is another example of overkill. With coverage of combustible areas by the prime system (two or more detectors are usually provided to insure against failure of a single detector), the need for a backup system is not necessary.

Comment 41 (Page 18, Section C.6.a.(2) - Refueling and Maintainance)

Fire extinguishers installed at strategic locations should be capable of fighting fires during refueling and maintenance.

Comment 42 (Page 18, Section C6-b)

Comments concerning the first paragraph are as follows:

a. Three hour fire barrier ratings for control room floors, ceilings, supporting structures and walls are unnecessary. The fire resistance rating of fire barriers should be based on the fire hazard analysis rather than an arbitrary three hour rating (see comments No. 17 and 19), or the 1-hour rating for peripheral rooms.

b. The use of CO_2 flooding systems in any areas associated with the control room complex introduces a potential safety hazard in that there is always the possibility of the gas seeping into occupied areas. Halon 1301 is much safer in this regard and if gas flooding systems are used in this area, they should be restricted to Halon.

Comments on the last paragraph are:

a. Large fully-enclosed raceways in these areas should be avoided due to the potential "chimney" effect.

b. If large fully-enclosed raceways are used (such as may be needed for electromagnetic shielding of low energy circuits), we believe a passive fire protection approach in which the raceway is sealed by fire stops at the openings is far better than the use of automatic fire suppression inside the raceway.

c. Combustible materials, power cables and other ignition sources are not allowed above the ceiling in the control room. It would seem that a well designed cable pan system using solid bottom pans with covers, containing only instrument and control cable so that internally generated fires are not likely and eliminating fire potential from external sources should allow routing a safety division cabling system above the control room ceiling thus allowing the benefits of a design which has cable entering the control room from above. Electrical cable tray systems in these areas present such a low fire hazard that manual fire suppression is adequate and even preferable to automatic systems for this area.

Section C.6.c. - Cable Spreading Room

Comment 43 (Page 19, Section C.6.c.)

The first paragraph requires automatic water system sprinklers. This general requirement does not recognize or give credit for flame retardant cables. Operation of such sprinklers will result in damage to Class 1E (electric) equipment either directly or by water seepage to remote areas of the plant.

It is unnecessary to make the primary fire suppression system an automatic water spray system. (Refer to General Concerns on Page 2)

The requirement that gas extinguishing system should be backed up with a fixed water spray system virtually eliminates gas systems since in our opinion no one would install a gas system with a fixed sprinkler system as a backup. Gas systems should be allowed with manual water hose systems as backup.

Advantages of a gas system that should be considered are:

a. A gas system (Halon or CO_2) will not cause failures in electrical control panels, etc. Water can and will if used finds its way into control panels (via cable trays) and perhaps in itself cause failures in redundant elements in separate safety divisions.

b. Using ionization detectors to initiate a gas system the fire protection function can be initiated much earlier in the life of a fire. The water system requires heat to initiate a sprinkler head and, therefore, the fire has reached a much greater intensity before initiation takes place.

c. Accidental initiation of a gas system is of no consequence to nuclear safety whereas the water system may cause problems even though precautions are taken against such problems.

d. The gas systems will, when initiated, limit propagation of a cable fire. This would allow time for fire fighters to take appropriate action if the fire is deepseated and persists. With ionization detectors and early gas discharge into an area the occurrence of a deepseated fire is unlikely.

The cable spreading rooms where a gas system can be applied is a controlled area and combustibles external to the cable system can be closely controlled, therefore, a large fire from an external source is not a likely event. The gas system because it is initiated early will not allow an internally (internal to the cable system) initiated fire to get started. It is unlikely that an internally generated fire will ever start since generally only control and instrumentation cable with its associated low energy are installed in this area.

Subparagraph (2) requires an excessive aisle separation between tray stacks. The cable spreading room is known to be a congested area and access difficulties would be anticipated and allowed for in fire brigade training. Aisle heights of 8'-0" would require cross trays to rise over the lower trays with which they interconnect. This would increase the congestion at higher levels and compound the complexity of the separation problem with a decrease in overall reliability. An aisle separation 2'-0" wide by 5'-0" high is more meaningful. In most cases firefighters will tend to appraoch a blaze in single file in a running crouch rather than side-by-side walking upright.

Subparagraph (5) which requires continuous line-type heat detectors in cable trays is entirely arbitrary, unnecessary, and undesirable for the reasons given in comment 27 (b).

Redundant safety-related cable divisions that are provided with separation and qualified equipment should not require additional separation by walls with a three hour fire rating. This requirement is in conflict with IEEE 279, which accepts physical separation. (Refer to General Concerns on Pages 1 and 2).

Consideration should be given to the following factors when requiring the separation of redundant safety division cabling systems by a three-hour fire wall.

a. The fact that fire protection systems will be installed coupled with the fact that flame retardant cable will be installed resulting in first a slow propagating fire (if it propagates at all) and secondly an extinguishing system which will put the fire out before any appreciable propagation takes place.

b. Physical separation requirements in IEEE-384 and Regulatory Guide 1.75 are adhered to during installation.

c. Use of good design and other options such as covered cable pans and solid bottom cable pans can provide effective protection between redundant safety systems.

d. The requirement of separate cable spreading rooms for each redundant division should not be necessary or required if safe shutdown can be achieved with a common room.

Section C.6.d. - Plant Computer Room

Comment 44 (Page 19, Section C.6.d)

The plant computer room firewall rating should be commensurate with the fire loading of the area which, in the instance of logging computers, is very low. Also, manual hose stations should not be provided for this sensitive electric equipment.

Section C.6.e. - Switchgear Room

Comment 45 - (Page 20, Section C.6.e.)

The opening sentence "Switchgear rooms containing safety-related equipment should be separated from the remainder of the plant by barriers with a minimum fire rating of three hours" is again not a justified requirement when the criteria is to preserve the "...capability to shut down the reactor and maintain it in a safe shutdown condition and to minimize radioactive releases to the environment in the event of a fire." The only requirement should be barriers necessary to separate one division of safety-related equipment from another division of safety-related equipment. The stated requirement addresses only the capital investment and should be deleted from the regulatory guide.

Section C.6.f. - Remote Safety-Related Panels

Comment 46 (Page 20, Section C.6.f.)

Manual hose stations should not be provided for remote safety panels because water will damage the electric equipment. Normal control is from the control room and susceptibility of fires at these remote panels is minimal.

Section C.6.g. - Station Battery Rooms

Comment 47 (Page 20, Section C.6.g.)

It is unnecessary to separate batteries from the plant or from each other by three hour rated fire barriers. The barriers should be commensurate with the hazard.

Section C.6.j - Diesel Fuel Oil Storage Areas

Comment 48 (Page 21, Section C.6.j.)

The Guide appears to assume simultaneous fire and loss of power without consideration of diesel generator redundancy. There is no reason to preclude location of fuel storage tanks below the diesel generators provided proper fire suppression systems are installed and provided the building would be able to retain structural capability if a fire occurs.

Cognizance should be taken that the fuel oil storage tanks are, themselves, safety related equipment. The greater the distance between the tanks and their respective redundant diesel engines the greater the probability of interconnecting piping failure. This section of the Regulatory Guide, again, addresses loss prevention and not nuclear safety.

Section C.6.k. - Safety Related Pumps

Comment 49 (Page 21, Section C.6.k.)

There is no need to separate every area containing safety related equipment by a three hour rated fire barrier. The location or need for these barriers should be selected on the basis of fire potential in the area and combustibles in the immediate vicinity.

References Section

Comment 50 (Pages 23 and 24)

Most of the references listed were not created with fire protection from a nuclear standpoint in mind.

The references listed under National Fire Association Codes and Standards are all directed towards preventing and putting out fires. None of these standards describe the problems associated with water in electric equipment. Standards should be listed that could be used to protect electrical equipment from the affects of hoses, running and falling water.

Other Documents Section

Comment 51 (Pages 24 and 25)

The following documents should be deleted as references:

NELPIA "Specifications for Fire Protection of New Plants"

Factory Mutual System Approval Guide - Equipment, Materials, Services for Conservation of Property

International Guidelines for the Fire Protection of Nuclear Power Plants, National Nuclear Risks Insurance Pools, 2nd Report (IGL)

These documents are inappropraite for references in a safety-related regulatory guide, because their primary emphasis is on reduction of property and equipment insurance risk and not on safeguarding the public.